

Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

AGRICULTURAL NOTES

PUBLISHED BY

PORTO RICO AGRICULTURAL EXPERIMENT STATION, MAYAGUEZ
OFFICE OF FARM MANAGEMENT, FEDERAL BUILDING, SAN JUAN

No. 13 Page 1.

San Juan, Porto Rico, March 1935.

SOME PINEAPPLE PROBLEMS.

5th ARTICLE. - ORGANIC MATTER.

By Henry C. Henricksen.

ITS ACTION UPON THE SOIL. - When a cover crop is plowed under it disintegrates and most of it disappears quickly, especially if the plant material is green and tender. The disintegration is a fermentation process in which the carbo-hydrates are oxidized, the final product being carbon dioxid, which is a gas and which escapes into the air. The fermentation is brought about by micro-organisms which are present in all agricultural soils in Porto Rico. The organisms work vigorously in this climate wherever the moisture conditions are favorable and whenever the disintegrating material contains an abundance of protein besides the carbo-hydrates. The fermentation of green succulent material is very rapid; usually a few weeks after plowing-under such material there is so little of it left that it can be determined only by the most exact chemical methods. It is pertinent, therefore, to ask: Why use cover crops? Is the benefit of a few weeks fermentation of organic matter commensurate with the cost of producing the crop? The answer is positive, for the pineapple plants are greatly benefited. The exact nature of the changes that are taking place in the soil and that are due to the fermentation of organic matter is perhaps very complicated. Reaction tests after fermentation usually show a numerically lower pH than before, that is greater acidity, but the difference is so small as to seem insignificant. A test of the colloidal matter usually shows that the soil suspension settles clear although it did not do so before the cover crop was added. That, as explained in the previous article, may be used as a measure of the suitability of a soil for pineapple growing, and in the present investigation it is the only reliable method, so far found.

The fermentation process by which organic matter is disintegrated in the soil is never complete. Some of the cellulose resists the action of micro-organisms and other agents and it remains in the soil for a long time. The amount of material remaining depends upon the kind of plants plowed under, the maturity of the crop and whether it is plowed under green or dry. A succulent plant naturally disintegrates faster and more completely than a woody one, an immature plant faster and more completely than a mature one and green or dry stands in the same relationship. That is to say, some of the plant material is always in such a condition that it resists disintegration, which accounts for the fact that some soils contain as much organic matter as they do. If all of the organic matter disappeared equally fast it is obvious that none would be left in the soil after a few months cultivation.

AGRICULTURAL NOTES

RECEIVED BY

STATION AGRICULTURAL EXPERIMENT STATION WASHINGTON
OFFICE OF HARM MANAGEMENT, FIELD & BUREAU, WASH. D.C.

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

1914

On the other hand when the extent of the disintegration is realized it will be understood that where the content of organic matter is high the accumulation represents many crops of such plants as the soil has been producing. In the Tropics no one crop, even though it may contain a high percentage of resistant fibre, will produce a large permanent increase in the soils humus content. Of course, that does not apply to peat deposits, but of those there are but few in the Tropics.

THE NECESSITY OF HUMUS. - This varies according to the soil. Its role is chiefly that of improving aeration, although that it retains water and fertilizer salts are often important factors. A sandy soil in which the coarse and fine particles are properly proportioned will produce good crops of pineapples even though the humus content is low. If, however, the coarse particles are lacking in such a soil humus becomes almost a necessity. But it is especially in clay soils that a small amount of humus shows its beneficial effect. Such soils are difficult to maintain in a perfect state of aeration without humus.

COVER CROPS. - It is usual to think of legumes when mentioning cover crops, but a cover crop does not necessarily need to be a legume. The legumes are preferable to non-legumes because they assimilate the nitrogen in the air. But in the improvement of pineapple soils tonnage of organic matter is the main consideration. As an example, elephant grass, producing 11 tons dry matter per acre, might be preferable to pigeon peas (gandules) producing but 7 tons, even though the latter may supply 200 lbs. more nitrogen. This is on the assumption that one plant is as valuable as another when used in rotation with pineapples. This, however, may not be the case. Investigations along that line are in progress but not finished.

SOME NOTES ON COVER CROPS. - On one plantation with sandy soil various cover crops are being grown in rotation with pineapples. Notes have been taken of these from time to time and a few results are tabulated here to show what may be expected from the different ones in fertile soil and under favorable conditions.

Date	Crop	Age Days	Height Feet	Planted Distance	Weight green matter incl. roots T. per A.	Dried at 105°C % dry mat- ter	Dry matter Tons per acre
Sept. 1924	Sword beans	180	3	2x2-1/2 ft.	17.5	19	3.32
Do	Do	90	7	Broadcast	40.5	35	14.17
	Crotalaria juncea						
Do	Do	180	11	2 x 4	48	25	12
Do	Do	180	6	Wild	18.5	40	7.4
Dec. 1923	Gandules	210	6	Broadcast thinly	30	45	9

On this plantation *Crotalaria juncea* has given the highest tonnage of any of the crops tried. The highest yield was obtained with 10 plants per square foot broadcasted, in the spring. Elephant grass yields well but it is inferior to *Crotalaria* in light soil and is a non-legume. The sword bean is not profitable on light soils; the wild *Urena lobata*, if it were sown so as to obtain an even stand, would yield twice as much dry matter. The gandul (pigeon pea) is a general favorite. It grows well in light soil and it seeds well. If planted in the spring broadcast, 5 to 10 plants per square foot, it will yield well and the stalks will not be too woody.

WHEN TO PLOW COVER CROPS UNDER. - As stated before, the green succulent matter disintegrates quickly whereas the dry fibrous matter persists for a longer time. The natural deduction, therefore, is that where the object is to quickly change the state of the colloidal matter in the soil the crop should be plowed under before it is mature and without being dried. If on the other hand the object is to preserve the humus the crop should be mature and dry before being plowed under. This problem has not yet been fully worked out, but it appears to be most economical to save the humus as much as possible and to change the state of the colloidal matter in some other manner.

PERCENTAGE OF HUMUS IN THE SOIL. - What that means in practice will be better understood when illustrated with the following example: The weight of a certain sandy soil in situ was found to be two million pounds per acre for seven inches of the surface layer. It was examined for humus, the content of which was found to be 1.12% calculated on the assumption that what is called humus contains 58% carbon. *Crotalaria* containing 25% dry matter was then plowed under at the rate of 40 tons per acre. That is 10 tons dry matter was added to two million pounds soil which is one percent. It was left six months, after which the beds were prepared and the plants set. In preparing, the soil and disintegrated organic matter was well mixed and one month later samples were ^{again} taken. The humus content was then found to be 1.34%, a gain of only 0.22%.

That example is illustrative of what can be expected from the addition of such organic matter. The amount left after disintegration seems small but the effect of it coupled with that of what had disappeared through fermentation was very important as shown by the growth of the pineapple plants.

